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ANNALES MEDICINAE EXPERIMENTALIS ET BIOLOGIAE FENNIAE

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STUDIES ON THE EFFECT OF THYROID EXTRACT, INSULIN, TESTOSTERONE AND CASTRATION ON THE SEMINAL VESICLE OF RAT

BY

ANTTI TELKKÄ and MATTI TUOVINEN

VOL. 32 1954 SUPPLEMENTUM 12

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The seminal vesicle is known to reflect readily the androlytic and andromimetic influences. The height of the epithelial cells of the seminal vesicle has been shown to be closely correlated with the male hormone present in body fluids (1, 7). The reaction of the seminal vesicle to androgens appears so distinctly that this reaction has been employed as an assay method for andromimetic substances (4, 6). Therefore, the seminal vesicle can be regarded as a suitable object for studying the andromimetic or androlytic properties of various substances.

There is relatively little evidence of the relations between the thyroid and the gonads and of the effect of insulin on gonads. The study now reported was carried out in order to investigate whether the administration of thyroxin and the administration of insulin affects the rat seminal vesicle as measured (a) from the weight of this gland, (b) from the width/height ratio of its epithelial cells, and (c) from the histochemically demonstrable succinic dehydrogenase activity of the seminal vesicle. For comparison, besides intact rats, also castrated and testosterone-treated were used.

MATERIAL AND METHODS

Thirty-five male albino rats of the Wistar strain, weighing 100—125 g, were used. Fifteen of them served as untreated controls. The animals were kept in separate cages. Five rats were castrated

30 days before sacrifice. Five rats received daily 1 mg of testosterone propionate (Organon) intramuscularly over a period of 30 days. Five rats received daily 0.2 ml of thyroid extract (»Thyranon», Organon, corresponding reportedly to 0.02 mg of organically bound iodine) subcutaneously over a period of ten days. Five rats received insulin (Medica) in daily doses of 0.5 units, likewise over a ten days period. After the experimental period, the animals and their respective controls were sacrificed by decapitation, the seminal vesicles and the testes were removed and weighed, the left vesicle and the testes were fixed in Bouin's fluid, embedded in paraffin and stained with Mallory's azan method. The width/height ratio of the epithelial cells of the seminal vesicle was measured from a projected picture of the specimen and expressed as a mean from measurements of 100 cells. The right vesicles were used for the histochemical demonstration of succinic dehydrogenase following the method of Seligman and Rutenburg (13) and using neotetrazolium as an indicator for succinic dehydrogenase.

RESULTS

The mean initial and final body weights, the absolute and relative weights of the testes and of the seminal vesicles, and the width/height ratio of the epithelial cells of the seminal vesicle are given in Table 1.

TABLE 1

	Controls (n=15)	Insulin Group (n=5)	Thyroid Extract Group (n=5)	Castrated (n=5)	Testosterone Group (n=5)
Initial body weight (g)	114 ±10	100 ±14	109 ±15	115 ±14	123 ±19
Final body weight (g)	172 ±14	177 ±18	142 ±18	167 ±18	169 ±21
Weight of seminal vesicles (mg)	616 ±20	919 ±48	663 ±39	63 ±13	1728 ±106
Weight of seminal vesicles (mg/g of body weight) ..	3.58 ±0.4	5.19 ±0.6	4.67 ±0.4	0.38 ±0.1	10.23 ±1.2
Weight of the testes (g)	2.44 ±0.2	2.63 ±0.2	2.17 ±0.2	—	2.29 ±0.2
Weight of the testes (mg/g of body weight)	14.2 ±0.5	14.9 ±08.	15.3 ±0.7	—	13.6 ±1.0
Ratio width/height of the epithelial cells of the seminal vesicle	37.4 ±0.3	24.4 ±0.8	26.0 ±0.6	81.9 ±0.5	19.3 ±0.9

Fig. 1. — Seminal vesicle of a castrated rat. ca. 300×.

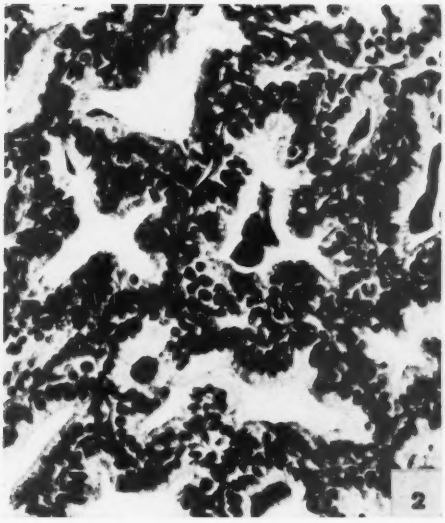

Fig. 2. — Seminal vesicle of a control rat. ca. 300×.

Between the final body weights there was no statistically significant differences, although the mean of the thyroxine group was below that of the controls. The weights of the seminal vesicles in the castrated and in the testosterone-treated groups differed significantly from the values of the other groups, and the weight of the seminal vesicle of the insulin group also differed significantly from the values of the controls and the thyroid extract-treated group. The differences in the relative weights of the seminal vesicles were statistically significant between all the five groups, while no differences could be established between the different groups in the absolute and relative weights of the testes.

Histological examination showed that the epithelial cells of the seminal vesicles in the castrated rats were nearly cuboidal (Fig. 1); their shape was more columnar in the controls (Fig. 2); their height was clearly increased, as compared with the controls, in the three experimental groups, being greatest in the testosterone-treated group (Figs. 3—5). The width/height ratio of the controls, of the testosterone-treated group and of the castrated animals differed significantly from the values of the other groups, whereas no difference was found between the ratios of the insulin group and

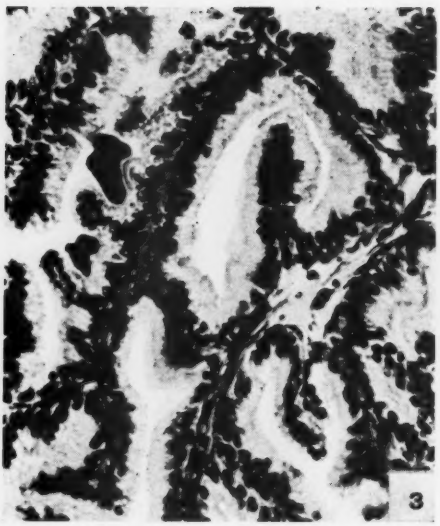

Fig. 3. — Seminal vesicle of an insulin-treated rat. ca. 300×.

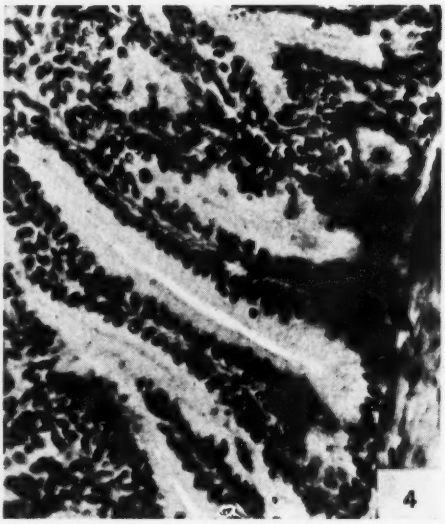

Fig. 4. — Seminal vesicle of a rat treated with thyroid extract. ca. 300×.

Fig. 5. — Seminal vesicle of a testosterone-treated rat. ca. 300×.

the thyroid extract-treated group. In the testes, no differences were found between the four group examined; mature spermia, premeiotic and meiotic figures in the nuclei could be observed in all groups.

In the histochemical demonstration of succinic dehydrogenase, the epithelial cells of the seminal vesicle showed a marked activity in the control animals. The treatment with insulin, with thyroid extract and especially with testosterone seemed to induce an increase in the enzymatic activity, whereas the seminal vesicle epithelium of the castrated animals remained consistently unstained.

DISCUSSION

Our observations on the effect of castration and of testosterone treatment on the cell height of the seminal vesicle epithelium are in agreement with the findings of previous investigators (1, 7, 9). Under our experimental conditions, the treatment with insulin and with thyroid extract seemed to have a stimulating effect on the epithelial cells of seminal vesicle. The experience gained in clinical work indicates that in hyperthyroidism there may be an increase in the sexual activity. Whether the stimulating effect of thyroid extract is mediated through the anterior pituitary, whether there is direct relationship between the thyroid and gonads, or whether the stimulation is connected with the non-specific action of thyroid hormone on the metabolism of all the body cells cannot be stated. In a recent investigation, Eastly and Leblond (3) studied the effects of thyroxine and found that in thyroidectomized rats, thyroxine promotes the growth of gonads only in the presence of the hypophysis.

It is well known that in diabetes, the sexual functions are frequently depressed, and that, in untreated diabetes of children, the development of sexual organs is delayed. These changes can usually be corrected with insulin therapy. These facts, however, cannot be taken as indications of a stimulative effect of insulin on the gonads; it is probable that the changes are merely due to the deranged metabolism in diabetes.

Succinic dehydrogenase activity of the seminal vesicle epithelium has escaped any notice in the previous literature concerned with

the histochemical distribution of this enzyme in animals (5, 8, 12). According to our results, the epithelial cells of the seminal vesicle, like so many other secretory epithelial cells, possess a marked succindehydrogenase activity. Our observations on the nearly complete disappearance of enzymatic activity in the seminal vesicle epithelium after castration concur with the earlier findings obtained with biochemical methods (2, 11). The biochemical results also suggest that the utilization of carbohydrate via the citric acid cycle of Krebs, in which succinic dehydrogenase is an essential link, may be stimulated in the male accessory sex organs under the influence of androgenic hormones (10), a finding which is also in agreement with the present histochemical results.

SUMMARY

The effect of thyroid extract and of insulin on the weight, on the width/height ratio of the epithelial cells, and on the succinic dehydrogenase activity of the rat seminal vesicle have been investigated. For comparison, castrated and testosterone-treated rats were used in addition to intact animals. Under the conditions of the present experiment, both insulin and thyroid extract especially seemed to have a stimulating effect on the seminal vesicle.

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